Waukesha Energy Usage and Air Emissions Clarification

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Additional Information on Energy and Greenhouse Gas Emissions

This memorandum is written in response to a Wisconsin Department of Natural Resources (WDNR) request for additional information regarding energy and greenhouse gas emissions for the water supply and return flow alternatives considered in the City of Waukesha Lake Michigan application.

1. Additional information on energy usage and greenhouse gas emissions.

   The energy usage for the water supply alternatives were based on two components, 1) pumping energy to supply the water from the source, and 2) treatment energy necessary to meet drinking water requirements for that source. The average day demand (ADD) flow, 10.1 million gallons per day (mgd), was used to estimate the energy for each water supply alternative. For return flow, the energy was estimated based on the pumping energy to return average day flow to the Lake Michigan watershed discharge location. An average day demand (ADD) flow of 11.7 million gallons per day was used to estimate the energy for each return flow alternative.

   The greenhouse gas emissions for the water supply alternatives were also based on two components, 1) emissions associated with the energy usage estimates described above, and 2) emissions associated with the production and transportation of chemicals required for drinking water treatment. Together the emissions for electricity usage and chemical production and transport comprise the total carbon dioxide equivalent (CO_2e) emissions estimate for each alternative.

   The CO_2e emissions for electrical energy usage were calculated using an emission factor of 1,859 pounds CO_2e/megawatt-hour (MWh). This is a factor obtained for coal fired power plants. This is considered conservative since the most recently published 2010 eGRID value for the Southeastern Wisconsin regional electricity supply is 1,511 CO_2e/MWh[1], which takes into account recent data for the regional electricity generation mix from coal, natural gas, renewables, etc.

   Quantities of treatment chemicals were calculated based on the treatment required for each alternative using a proprietary software tool, CPES™. The ADD flow and CO_2e emission estimates were made for production and transportation of these chemical quantities.

   In reviewing the energy usage and emissions two corrections were identified: energy usage for the Deep and Shallow Aquifers alternative and energy usage for the Shallow Aquifer and Fox River Alluvium alternative. An updated table (ER Table 6-71) for estimated energy use and greenhouse gas emissions is included below. The table includes an added return flow alternative to Lake Michigan via the Milwaukee Metropolitan Sewerage District (MMSD) South Shore Water Reclamation Facility by sending treated return flow directly to the MMSD outfall.

[1] U.S. EPA eGRID 9th edition Version 1.0 (2010 data: eGRID sub-region RFCW CO_2e total output emission rate). (February, 2014)

TABLE 6-71 (REVISED 2/2015)
Estimated Energy Use and Greenhouse Gas Emissions

Alternative	Estimated Annual Energy Usage (MWh)	Estimated Annual GHG Emissions (tons CO_2)
Water Supply		
Deep and Shallow Aquifers	23,700	24,600
Shallow Aquifer and Fox River Alluvium	21,200	22,400
Lake Michigan (City of Milwaukee)	11,500	13,200
Lake Michigan (City of Oak Creek) Alignment 1	16,000	17,300
Lake Michigan (City of Oak Creek) Alignment 2	14,200	15,700
Lake Michigan (City of Racine)	16,100	17,500
Return Flow Alternatives for Lake Michigan Water Supplies		
Underwood Creek to Lake Michigan	2,700	2,500
Root River to Lake Michigan Alignment 1	4,400	4,100
Root River to Lake Michigan Alignment 2	7,300	6,800
Direct to Lake Michigan	4,600	4,300
MMSD South Shore Outfall to Lake Michigan	8,100	7,500

Note: the energy use and greenhouse gas emission estimates were based on an ADD of 10.1 mgd for water supply alternatives and average daily flow of 11.7 mgd for return flow alternatives; greenhouse gas emissions will change proportionally with a change in ADD or average daily flow.

2. Energy usage compared to regional generating capacity.

   WE Energies is the current and only power provider for Southeastern Wisconsin. According to the WE Energies 2013 10K report, WE Energies has an electrical generating capacity of 6,021 MW. Assuming the capacity is available 24 hours per day 365 days per year the capacity would be 52.7 million MWh. In 2013 the utility had a demand, or sales, of 33 million MWh. The utility is predicting a flat to 0.5 percent growth rate for the foreseeable future. The most energy intensive alternative has a total energy estimate of 23,700 MWh, an increase of 14,700 MWh over historical energy usage (see below). This future energy demand equates to approximately 0.04 percent of the total capacity of the utility and the increase in energy usage from baseline would be less than 0.06 percent of the remaining excess capacity of the utility. This indicates the local electrical utility will have sufficient capacity to meet even the most energy intensive alternative without need for building additional power plants for the foreseeable future.

3. Electrical and greenhouse gas comparison to historical usage.

   The ADD for the current water system from 2008 through 2012 averaged 6.9 mgd, while the energy comparison for future water supply alternatives assumes the future ADD of 10.1 mgd.

   The historical energy usage is lower than what is estimated for the future water supply alternatives due to a higher water demand in the future. The future energy demand is also influenced by alternative-specific water treatment processes needed to meet drinking water requirements. Under baseline conditions the CO_2e values reflect energy sources only because much less chemical is used for baseline water treatment compared to the future water supply alternative treatment.

Historical water and energy usage for well water pumping and treatment are included in Table 2. Table 3 provides a comparison of the energy and emissions for each alternative to the historical average, or baseline condition.

TABLE 2
Historical Well Pumping and Treatment Energy Usage 2008-2012

Year	Total well energy use (KWh)	Total energy use (MWh)	Annual Total Pumping (million gallons)	ADD (mgd)
2008	8,997,590	8,998	2,528.93	6.93
2009	8,914,937	8,915	2,479.91	6.79
2010	8,807,054	8,807	2,441.22	6.69
2011	9,070,425	9,070	2,545.10	6.97
2012	9,180,090	9,180	2,536.37	6.95
Average:	8,994,019	8,994	2,506	6.87

TABLE 3

Energy and Greenhouse Gas Emissions Comparison to Baseline Conditions

Alternative[3]	Estimated Annual Energy Usage (MWh)	Energy Difference from Baseline (MWh) Rounded to the Nearest 100	Percent Energy Change from Historical Usage	Estimated Annual GHG Emissions[4] (tons CO2e) Rounded to Nearest 100	GHG Difference from Baseline (tons CO2e)	Percent GHG Increase Relative to Historical Usage
Water Supply & Water Treatment						
Deep and Shallow Aquifers, baseline current conditions[1]	8,994			8,400		
Deep and Shallow Aquifers[2]	23,700	14,700	163%	24,600	16,200	193%
Shallow Aquifer and Fox River Alluvium	21,200	12,200	136%	22,400	14,000	167%
Lake Michigan (City of Milwaukee)	11,500	2,500	28%	13,200	4,800	57%
Lake Michigan (City of Oak Creek) Alignment 1	16,000	7,000	78%	17,300	8,900	106%
Lake Michigan (City of Oak Creek) Alignment 2	14,200	5,200	58%	15,700	7,300	87%
Lake Michigan (City of Racine)	16,100	7,100	79%	17,500	9,100	108%
Return Flow Alternatives for Lake Michigan						
Underwood Creek to Lake Michigan	2,700			2,500		
Root River to Lake Michigan Alignment 1	4,400			4,100		
Root River to Lake Michigan Alignment 2	7,300			6,800		
Direct to Lake Michigan	4,600			4,300		
MMSD South Shore Outfall to Lake Michigan	8,100			7,500		
Preferred System Alternative						
Lake Michigan (City of Oak Creek) Alignment 2 with Root River to Lake Michigan Alignment 2 Return Flow	21,500	12,500	139%	22,500	14,100	168%

[1] Baseline conditions are 5 year average data from 2008 to 2012, 6.87 mgd average over that time period from current wells and reflects the current treatment costs paid for by the Waukesha Water Utility

[2] Future demand at 10.1 mgd, includes alternative-specific treatment.

[3] All Lake Michigan supply and treatment demands will require one of the return flow alternatives.

[4] GHG emissions are estimated by multiplying the energy consumption by 1,859 pounds CO2e/MWh (coal fired utility rate) plus GHG emission associated with water treatment chemicals